The Metal's Edge

The Rare Earth Dilemma: Trading OPEC for China

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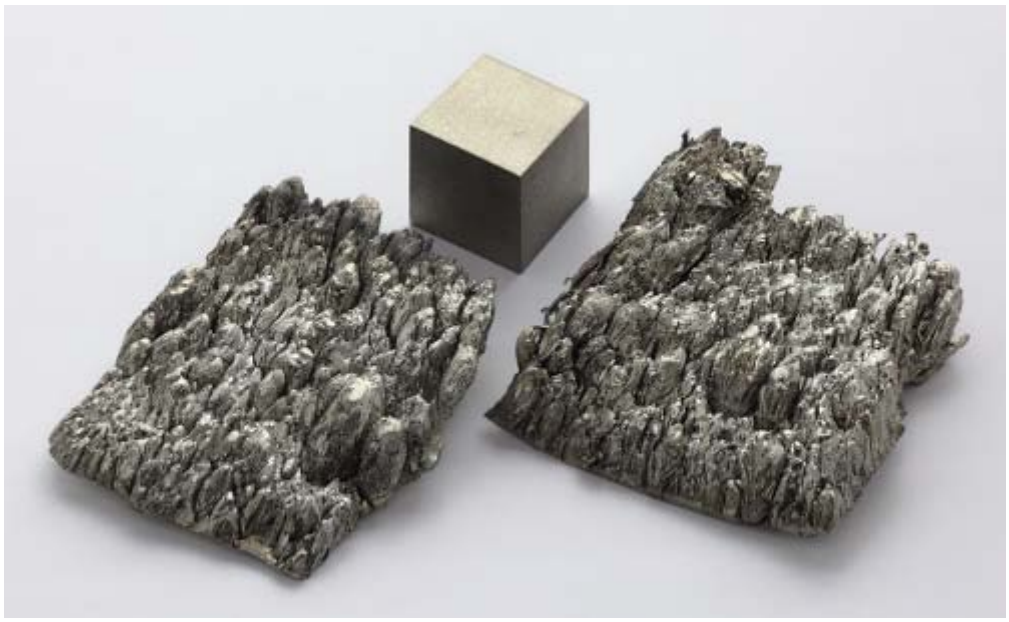

Scandium, one of the rare earths

This is the first of a three-part series about rare earth elements.

In a quest to reduce dependence on foreign imported oil and natural gas, many countries are turning to green technologies. In July 2010, former CIA Director James Woolsey told a group of over 250 people at Temple Beth Jacob in Los Angeles that if the U.S. could undermine oil's monopoly on transportation, then Americans can free themselves from having to kowtow to "dictators and autocratic kingdoms," such as Saudi Arabia and other members of OPEC.

Woolsey compared oil to salt. Through the end of the nineteenth century salt was considered a strategic commodity, making it a source of conflict, because it was needed to preserve meat. It was only through innovations, such as refrigeration, freezing, and canning, that salt was finally stripped of its strategic value, ending the salt wars.

Today, we are faced with a new issue, which involves the ever increasing concern over energy security. As anxiety over energy security and global warming rose during the twenty-first century, the concept of green energy became increasingly prominent. The idea of these green technologies, such as plug-in hybrid vehicles, wind turbines, compact fluorescent lamps, and other energy efficient devices began to gain popularity. Not only do they reduce the amount of consumption of fossil fuels, but they are also viewed as more environmentally friendly.

Unfortunately, green technologies are turning out to be not that simple. Green technologies rely heavily on rare earth elements (REE), and China dominates the REE industry.

REEs are those chemical elements known as the lanthanides (atomic numbers 57 through 71 on the periodic table), scandium (atomic number 21), and yttrium (atomic number 39). Scandium and yttrium are generally grouped with the lanthanides because of their similar properties.

Contrary to their name, REEs are not rare at all. They can be found in low concentrations throughout the Earth's crust, and in higher concentrations in numerous minerals. Rare earth elements can be found in almost all massive rock formations. However, their concentrations range from ten to a few hundred parts per million by weight. Therefore, finding them where they can be economically mined and processed presents a real challenge.

REEs have unique chemical and magnetic compositions that make them ideal for modern technologies ranging from cellular telephones, laptop computers, and communication systems to military systems. Green energy technology is the one use that has the media making the most noise.

During the 2009 Minor Metals and Rare Earths Conference in Beijing, Mark Smith, Chief Executive Officer of Molycorp Minerals, the company that owns and operates Mountain Pass rare earth mine in California, explained the significance of rare earth in green technologies by saying, "We've coined the term, 'the green elements' because there are so many applications right now—hybrid electric vehicles, wind powered generation … permanent magnet generators, compact fluorescent light bulbs … just to name a few. Rare earths are absolutely indispensable. They (green technologies) will not work without rare earths."

The United States was once the largest global supplier of REEs. Today, however, after driving out nearly all of its competitors around the world through low pricing, China produces over 95 percent of the world's REEs. In addition, the country has been cutting back its export quotas. In June, China cut these quotas by a staggering 72 percent for the remainder of the year. Many analysts view the cutting back of export quotas as a way to force international companies to move their manufacturing operations to China, which will bring employment to and higher tax opportunities for the country.

From China's standpoint, because it has the largest population (over 1.3 billion people) in the world and staggering economic growth, the country needs to look after its own interests. In order to successfully continue its current rate of economic growth, China needs to be able to bring along its own people and take care of energy needs that help to fuel its economic growth.

China, as of July, is the largest consumer of energy in the world. China is also the second largest consumer of oil in the world, behind the United States, and the largest producer and consumer of coal. Like many other countries, China is keen on expanding its energy resources to include green technologies because of environmental concerns associated with oil and coal. China also wants to diversify its energy resources to increase its own energy security.

The use of solar and wind power are set to increase exponentially in China. Jack Lifton, an independent consultant and commentator, attended the 2010 China Rare Earth Summit, which took place in August in Beijing. In a report he wrote, "It was pointed out (during the Summit) that China built and installed 13 gigawatts of wind turbine electricity generating capacity last year, using rare earth permanent magnets for efficiency and low maintenance. The astounding prediction was made that by 2020, China will install an additional 330 gigawatts wind power capacity, with each 1.5 megawatt generator requiring one metric ton of neodymium-iron-boron magnet alloys."

In some of the newer generation wind turbines, *two tons* of rare earth magnets are required in the permanent magnet generator that goes on top of the turbine. Therefore, according to Mark Smith, "If the permanent magnet is two tons, then 28 percent of that, or 560 lbs, is neodymium."

In another example, China, which has the fastest growing vehicle market in the world, hopes to one day become the largest manufacturer of "green" vehicles, which are heavily dependent on REEs. This would likely require an abundance of REEs. For example, by some estimates, the

Toyota Prius requires some 25 pounds of REEs for each vehicle built. At this point, with the current rate of technology, it would be impossible to build a Prius without them.

Ironically, hybrid vehicles are being put into place to minimize dependence on imported oil. However, since manufacturing hybrid vehicles requires so much rare earth, then dependence on oil imports is being traded for dependence on rare earth imports. The gap needs to be addressed soon.

In 2008, the global consumption rate of REEs was approximately 124,000 tons. Of that, 74,000 tons were consumed by China, 24,500 tons by Japan, and 15,500 tons by the United States. By 2014, global demand is projected to be between 180,000 and 200,000 tons per year, with Chinese supplies falling short of global demand.

Countries have been scrambling, trying to secure adequate future supplies of REEs. According to a report written by Paul Mason, *BBC Newsnight*'s economics editor, having jumped into the electronic vehicle game early, Japan's car manufacturers rely heavily on REEs. In early 2009, Japan struck a deal to set up a rare earth mine in Vietnam. The mine will solely produce for Japan's vehicle manufacturers.

In November 2009, an article published by *The Australian*, reported that Japan is "increasingly looking to secure further resource supplies in Australia, with a focus on rare earths, to stem the dominance China has on the market." Tomio Harada, the Australian general manager of the government-backed Japan Oil, Gas & Metals National Corp, Jogmec, pointed out that it was more preferable to enter into a joint venture with a Japanese company than with a state-owned Chinese company. Harada said that China's interest was driven by the need for control. Japan, on the other hand, is aware of the national interest concerns in Australia.

The U.S. Congress has begun to take on the issue. In March 2010, U.S. Congressman Mike Coffman introduced a bill, known as the Rare Earths Supply-Chain Technology and Resources Transformation Act (RESTART) of 2010, aimed at reestablishing a competitive domestic rare earth supply chain.

There are many hurdles to overcome before rebuilding a domestic supply chain. However, this does not mean that we should not pursue alternative energy sources or long-term supplies of REEs because they are vital for hundreds of high technology applications that go well beyond energy. The question lies in China's dependability as a future supplier of REEs. Another question focuses on how we should divide up our dependence on energy and high tech applications.

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